PLATE 652. Fig. 1, Basal pinna of var. *latiusculum*, × ⅓; Fig. 2, Basal pinna of var. *pseudocaudatum*, × ½; Fig. 3, Next to basal pinnule of a basal pinna of var. *africanum*, × ½; Fig. 4, Frond of variant of var. *latiusculum*, × 1/6; Fig. 5, Next to basal pinna of var. *pubescens*, × ⅓.

PLATE 653. Fig. 1, Upper half of middle pinna of var. *esculentum*, × ½; Fig. 2, Basal pinna of small plant of var. *yarrabense*, × ½; Fig. 3, Upper pinna of var. *arachnoideum*, × ⅓; Fig. 4, Tip of frond of var. *caudatum*, × ½.

AN OLD FOREST IN STONINGTON, CONNECTICUT

HUGH M. RAUP

ON November 18, 1939, the writer had occasion to visit, in company with a group of students in Ecology, a piece of old woodland at the mouth of the Pawcatuck River in southeastern Connecticut. The area is of particular interest because it has been considered by some to have been not far removed from a primeval condition. Like so many of our supposed or actual remnants of the virgin forests in southern New England, it suffered great damage during the hurricane of 1938, and there now remains only a battered representation of the once handsome stand of trees.

The late Dr. G. E. Nichols, in describing the virgin forests in Connecticut wrote an account of the tract.[1] Since this account gives an excellent picture of the forest, and since such descriptions now take on rather more historic interest than they had before the hurricane, it seems worth while to quote Dr. Nichols in full.[2]

"Southeastern Connecticut, so far as ascertained, possesses only one possible fragment of original forest and, notwithstanding the owner's assurance that the area has never been cut over, the writer must confess to some doubt as to the primeval nature of the tract. The area in question, some 40 acres in extent, occupies a low hill bordering the Sound at the mouth of the Pawcatuck River in the town of Stonington. In contrast to the forests heretofore described there is a complete absence of hemlock, beech, sugar maple, yellow birch, pine, and even chestnut. The character trees are white oak and black oak (*Quercus velutina*), especially the former, associated with which are shagbark hickory and red maple. The stand is of a more open character than in any of the areas previously mentioned and in general aspect the forest resembles the climax oak-hickory type of the Chicago region.

[1] Nichols, G. E. "The Vegetation of Connecticut" II, Torreya **13**: 214–215 (1913).

[2] No photograph of the Stonington tract was published by Dr. Nichols. The writer is indebted to Dr. H. J. Lutz of the School of Forestry at Yale for making a thorough, though unavailing, search in Dr. Nichols' files for any photograph that the latter may have had.

Trees with a diameter of from 45 to 60 centimeters are common. The ground is not deeply shaded and the low, dense underbrush is quite xerophytic, being composed largely of *Gaylussacia baccata*, *Vaccinium corymbosum*, *Vaccinium stamineum*, and *Corylus americana*. It is of course not impossible that the xero-mesophytic nature of the tract is due to its extremely exposed location and that it really represents a virgin forest. Moreover it must be borne in mind that in general the forests of eastern Connecticut are less mesophytic than are those in other parts of the state."

At the time of the writer's first visit, the loggers were actively engaged in clearing out the tangle of fallen stems and branches which resulted from the hurricane. Nearly all of the tract was destroyed, leaving only a few scattered trees on the north, or landward side. A considerable number of logs of fair quality were being taken out, leaving newly cut stumps upon which ring counts could be made. In the short time available only eleven stumps were counted, ranging in number of rings from 110 to 136. Two facts were apparent: first, the trees all showed relatively wide rings in their early period of growth; and second, their average age was approximately 123 years which was the length of time between the hurricane of 1815 and that of 1938.[1] Since they were among the largest and oldest trees in the stand there seemed some evidence that Dr. Nichols' chariness about considering the forest to be entirely unmodified might be well founded. The spread in ages among the trees remained to be explained, however, and it was especially desirable to find some more conclusive evidence of an actual release which could be attributed to a cataclysm similar to that of 1938.

With these problems in mind, the tract was visited again in May, 1940. The logging operations were then nearly completed, and many more stumps were available. Fifty-one were counted on this occasion, all of them solid, or nearly so, to the core, and cut from one to three feet above the base. Most of them may be divided roughly into two age groups. The smaller of these consists of five trees, all of which contained over 140 clearly visible rings. All of these showed a distinct release, indicated by a more or less sudden widening of the rings, immediately after 1815. The larger group, as indicated by the earlier observations, con-

[1] Channing, Walter (Editor). New England Hurricanes, 1635, 1815, 1938. Boston, 1939. Brooks, Charles F. Hurricanes into New England: Meteorology of the Storm of September 21, 1938. Geog. Rev. **29**: 119–127 (1939).

sisted of 41 trees in which, judging by field observations, no obvious release was evident near the center. In the case of those with ages under 123 years none could be expected if the 1815 hurricane were significant; but some 21 individuals showed ages ranging between 124 and 140, and might be expected to have experienced a release after 1815.

There is no way of knowing how many years must be added to the count for each tree to round out its full life, unless each could be dissected to the very base. If, however, a release in 1815 is accepted, then it is to be expected that seedlings and small trees existing at that date had previously been suppressed in greater or less degree depending upon their ages and local positions in the ancient forest. Counts were made on two small trees in the advance growth under the forest which was blown down in 1938. Both of these were young white oaks, growing in the shrubby cover of *Gaylussacia*, *Vaccinium*, and *Corylus*. One of them, 2 feet high, had a stem only about six inches long and about one half an inch in diameter. The other was four feet tall, with a stem about two feet long, and a diameter of about five-eighths of an inch at the base. The first proved to be twenty-nine years old, and the second sixteen years. In both the rings were so close together and confused that microscopic sections had to be made before good counts were possible[1]; and both showed a sudden release after 1938. That is, there was one unusually wide ring at the outside which constituted the growth of 1939.

Two suggestions are to be derived from these observations. One is that about half of the trees blown down in 1938 began as seedlings or sprouts immediately after 1815, or were present as suppressed advance growth in a forest which existed prior to 1815, and were released at that time. Second, the absence of a release in the 21 trees showing 123 to 140 rings may be due to a certain amount of clearing prior to 1815. At the margins of the tract there are some areas that have been pastured considerably, with grassy glades and a partial cover of blackberry bushes. Old white-oaks growing in these spots showed no release in 1815, indicating that similar conditions may have existed at that time, possibly more widespread than subsequently.

The five older trees, which showed a definite release, had at-

[1] The writer is indebted to Mr. F. C. Barghoorn for cutting these sections.

tained such size in 1815 as to have reached up into better light and to have begun to put on more wood with more clearly defined rings each year. The oldest of the five showed about 180 rings on the stump to which must be added a considerable number for the years required to reach stump height. The rings nearest the center were, as would be expected, very small, but there followed a period of gradual increase to 1815 when the tree was about six inches in diameter. After the sudden release of 1815 it began to put on wood much faster. All of these five old trees had minute rings near the center, clearly indicating suppression. There seemed to be no close relationship between the diameter of the trees and their age. Some that were 12 to 15 inches in diameter were fully as old as those two feet or more in diameter.

Another observation which bears out the theory that the 1815 hurricane was responsible for a great amount of damage is that the older trees counted, that is, those which had attained some size by 1815 and were reaching toward the canopy, were all on the landward side of the tract where they would not be subject to quite so much wind as those nearer the shore line. It has already been noted that the remnants of the last hurricane are for the most part on the landward side.

This study indicates that the old oak-hickory wood at Stonington was far from unmodified prior to the hurricane of 1938; that it was seriously damaged in 1815, presumably by the hurricane of that year; and that its canopy had been partially opened before 1815. There is also the suggestion that in spite of the early clearing, and in spite of devastating destruction in 1815, it did not change much in its hardwood composition. The existence of advanced growth of white oak, black oak, hickory, and red maple, suppressed because of a dense canopy prior to 1815, suggests that the trees in that canopy were not far different from those which were destroyed recently. An alternative hypothesis would be that prior to 1815 there had been some very old second growth or primeval forest of other facies which might have created a habitat similar to that which now appears in our old field white pine or red cedar stands. Such a primeval forest is not consistent, however, with the early accounts of the coastal vegetation in this

region, which describe forests of oaks, hickories, and chestnuts.[1] Furthermore, it does not seem at all likely that in a growing colony along the coast, farm-land could have been cleared, used, and abandoned so long prior to 1815 as to give rise to old-field stands which could have created such a habitat.

Between 1815 and 1938 there is no evidence of release cutting. There are no sudden breaks in the development of wood except for occasional periods of very slow growth, probably due to dry or cold seasons. One such period occurred about 1890, and lasted for three or four years.

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Remarks on the Name Phlox nivalis.—In Rhodora xlii. 476 a question is raised as to the validity of the name *Phlox nivalis* as applied to the subulate-leaved species of the southeastern Coastal Plain and Piedmont. While this name, when proposed by Loddiges, was not accompanied by an adequate description, it was validated by Sweet in Brit. Flow. Gard. ii. no. 185 only four years later. The latter author published a more faithful representation of the habit of the plant than had been given by Loddiges' crude plate, and also an accurate drawing of the floral parts. His text included a detailed english description and a latin diagnosis, so that all requirements are fulfilled.

Nuttall's name *P. Hentzii* was not published until seven years later, and his diagnosis was not so full as that of Sweet. A sheet in the herbarium of the Academy of Natural Sciences of Philadelphia bears an annotation by Nuttall which shows that he was familiar with the earlier name, but he failed to mention this when he proposed his new one. Under our present rules of nomenclature Nuttall's name is to be rejected as superfluous when published, and the plant should be known as *Phlox nivalis* Lodd. ex Sweet.—Edgar T. Wherry, University of Pennsylvania.

[1] For reviews of early descriptions of southern New England Forests see Bromley, Stanley W. *The original Forest Types of Southern New England*, Ecol. Monog. **5**: 61–89; and Raup, H. M. *Recent Changes of Climate and Vegetation in Southern New England and Adjacent New York*, Jour. Arn. Arb. **18**: 79–117.